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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/292,186	04/15/1999	DANIEL M. KINZER	IR-1609-(2-1	3190

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EXAMINER

HU, SHOUXIANG

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 03/04/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/292,186	Applicant(s) Kinzer	
	Examiner First Last	Art Unit 1234	
<i>-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --</i>			
Period for Reply			
<p>A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.</p>			
<ul style="list-style-type: none"> - Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication. - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely. - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication. - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). - Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b). 			
Status			
<p>1) <input checked="" type="checkbox"/> Responsive to communication(s) filed on <u>Dec 31, 2001</u></p>			
<p>2a) <input checked="" type="checkbox"/> This action is FINAL. 2b) <input type="checkbox"/> This action is non-final.</p>			
<p>3) <input type="checkbox"/> Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under <i>Ex parte Quayle</i>, 1935 C.D. 11; 453 O.G. 213.</p>			
Disposition of Claims			
<p>4) <input checked="" type="checkbox"/> Claim(s) <u>1, 3-6, 8-13, and 20-22</u> is/are pending in the application.</p>			
<p>4a) Of the above, claim(s) _____ is/are withdrawn from consideration.</p>			
<p>5) <input type="checkbox"/> Claim(s) _____ is/are allowed.</p>			
<p>6) <input checked="" type="checkbox"/> Claim(s) <u>1, 3-6, 8-13, and 20-22</u> is/are rejected.</p>			
<p>7) <input type="checkbox"/> Claim(s) _____ is/are objected to.</p>			
<p>8) <input type="checkbox"/> Claims _____ are subject to restriction and/or election requirement.</p>			
Application Papers			
<p>9) <input type="checkbox"/> The specification is objected to by the Examiner.</p>			
<p>10) <input type="checkbox"/> The drawing(s) filed on _____ is/are objected to by the Examiner.</p>			
<p>11) <input checked="" type="checkbox"/> The proposed drawing correction filed on <u>Aug 15, 2000</u> is: a) <input checked="" type="checkbox"/> approved b) <input type="checkbox"/> disapproved.</p>			
<p>12) <input type="checkbox"/> The oath or declaration is objected to by the Examiner.</p>			
Priority under 35 U.S.C. § 119			
<p>13) <input type="checkbox"/> Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).</p>			
<p>a) <input type="checkbox"/> All b) <input type="checkbox"/> Some* c) <input type="checkbox"/> None of:</p>			
<p>1. <input type="checkbox"/> Certified copies of the priority documents have been received.</p>			
<p>2. <input type="checkbox"/> Certified copies of the priority documents have been received in Application No. _____.</p>			
<p>3. <input type="checkbox"/> Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).</p>			
<p>*See the attached detailed Office action for a list of the certified copies not received.</p>			
<p>14) <input checked="" type="checkbox"/> Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).</p>			
Attachment(s)			
<p>15) <input type="checkbox"/> Notice of References Cited (PTO-892)</p>		<p>18) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____</p>	
<p>16) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)</p>		<p>19) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)</p>	
<p>17) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____</p>		<p>20) <input type="checkbox"/> Other: _____</p>	

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DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 3-6, 8-13 and 20-22 are rejected under 35 U.S.C. 103(a) as being obvious over Floyd et al. ("Floyd"; 6,090,716).

Floyd disclose a trench-type power MOSFET device (Figs. 1 and 10), each of the trench-type MOSFET comprising: a vertical invertible channel composed of a first conductivity type (52) between a heavily doped source region of a second conductivity type (50) and a heavily doped drain region of the second conductivity type (54); gate oxide wall (56), a polysilicon trench gates of the second conductivity type (58A), a source contact (66) in contact with the source region, wherein the layer of the channel material is an epitaxial layer and has a constant concentration along its full length (see Fig. 11).

In the embodiment of Fig. 1 in Floyd, the MOSFET device is an n-p-n polarity type, with the first conductivity type being a p type and the second conductivity type being an n type. Although Floyd does not expressly disclose that the MOSFET device

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can also be a p-n-p polarity type, it is well known in the art that a MOSFET design which works under one polarity type is normally also workable under the reversed polarity, as evidenced in the prior art such as Floyd et al. (6,069,043; see Figs. 3 and 11) and Darwish et al. (5,674,766; see col. 11, lines 20-22).

Therefore, it would have been well within the ordinary skilled in the art at the time the invention was made to make the MOSFET device of Floyd with the polarity being reversed, so that desired device polarity and improved design flexibility would be achieved.

Regarding claim 3, it is noted that Si is the most widely used semiconductor material.

Regarding claims 4 and 5, the MOSFET device of Floyd with reversed polarity can inherently have a reduced on resistance and be bidirectional, as it is basically identical to the claimed structure.

Regarding claims 8, 11-13, although Floyd does not expressly disclose that the channel layer can have a resistivity of about 0.17 Ohm-cm and a thickness of about 2.5 um, and that the substrate has a resistivity less than 0.0005 Ohm-cm, it noted that it is old and well known in the art the threshold voltage and the on-resistance of MOSFET are directly correlated to the doping concentrations of the channel layer and the substrate layer; and they are the well recognized parameters of importance subject to routine experimentation and optimization.

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Therefore, it would have been obvious to one of ordinary skilled in the art at the time the invention was made to make the MOSFET device of Floyd with the channel layer having a resistivity of about 0.17 Ohm-cm and a thickness of about 2.5 um and the substrate having a resistivity less than 0.0005 Ohm-cm, so that the desired threshold voltage and the on-resistance of the MOSFET would be achieved.

Regarding claims 6 and 20-21, it is noted that it is well known in the art that it is desirable to have a source electrode in direct contact with both of the heavily doped source region and the channel-forming base region through a heavily doped base region for improving the device stability, as evidenced in the prior art, such as in Fig. 12 of Floyd et al. (6,069,043) and in Figs. 1,2 and 4 of Darwish et al. (5,674,766).

Response to Arguments

3. Applicant's arguments filed on 12/31/01 have been fully considered but they are not persuasive.

In response to applicant's argument that the applied prior art references fail to disclose the advantages obtained in the present invention, the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). As explained in the claim rejection and as evidenced in the prior art such as

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Floyd et al. (6,069,043; see Figs. 3 and 11) and Darwish et al. (5,674,766; see col. 11, lines 20-22), one of ordinary skill in the art would readily recognize that a MOSFET design which works under one polarity type is normally also workable under the reversed polarity. It would therefore have been well within the ordinary skilled in the art at the time the invention was made to make the MOSFET device of Floyd (6,090,716) with the polarity being reversed, so that desired device polarity and improved design flexibility would be achieved. And, the advantages obtained in the present invention would flow naturally from the MOSFET device of Floyd (6,090,716) after the polarity being reversed.

Conclusion

4. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

5. Papers related to this application may be submitted to Technology center (TC) 2800 by facsimile transmission. Papers should be faxed to TC 2800 via the TC 2800 Fax center located in Crystal Plaza 4, room 4-C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The Group 2811 Fax Center number is (703) 308-7722 or 308-7724. The Group 2811 Fax Center is to be used only for papers related to Group 2811 applications.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Shouxiang Hu** whose telephone number is **(703) 306-5729**. The examiner can normally be reached on Tuesday through Friday from 7:30 AM to 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Tom Thomas**, can be reached on **(703) 308-2772**. The appropriate fax phone number for the organization where this application or proceeding is assigned is **(703) 308-7724**.

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Any inquiry of a general nature or relating to the status of this application should be directed to the **Technology Center Receptionists** whose telephone number is **(703) 308-0956.**

Shouxiang Hu

February 26, 2002

Steven Loh
Primary Examiner

